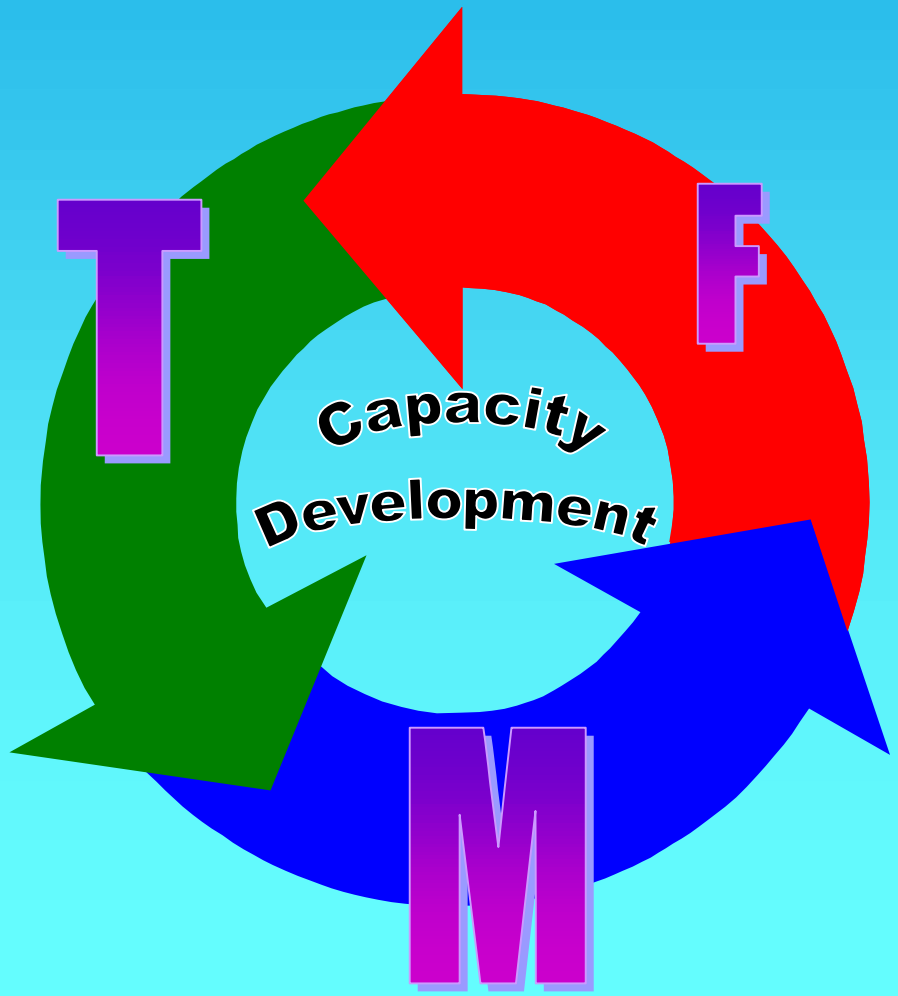
Drinking Water

Deana Cash

Public Drinking Water Program

Missouri Department of Natural Resources

Technical, Managerial, Financial Capacity



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Drinking Water

- Who runs your water system?
- What would happen if your system quit dispensing water tomorrow?
- Can your system keep doing the job indefinitely?
- Cable TV or the monthly water bill…..which is too expensive?

Agenda

- Water system classes
- Sources
- Treatment
- Storage and distribution
- Terrorism
- Systems management
- Resources

Types of Regulated Water Systems

Community Water System (CWS)

- 15 connections or serves 25 residents year-round (1450 regulated by MDNR)

Non-Transient Non-community Water System (NTNCWS)

- Serves 25 of the same people 6 months of the year (factories, schools, hospitals) (250 regulated by department)

Types of Water Systems (cont.)

Transient Non-community Water System (TNCWS)

- Systems providing water in a place where people do not remain for a long time (campgrounds, restaurants)

  (1,060 regulated by department)

New Rule-Continuing Operating Authority (COA) Priority

New water systems are required to connect to a higher priority COA. Priority is as follows:

- Municipality, PWSD, PSC regulated
- Private owned (person is responsible)
- Home owner's associations

Otherwise, waiver must be granted by higher COA to build a new separate system

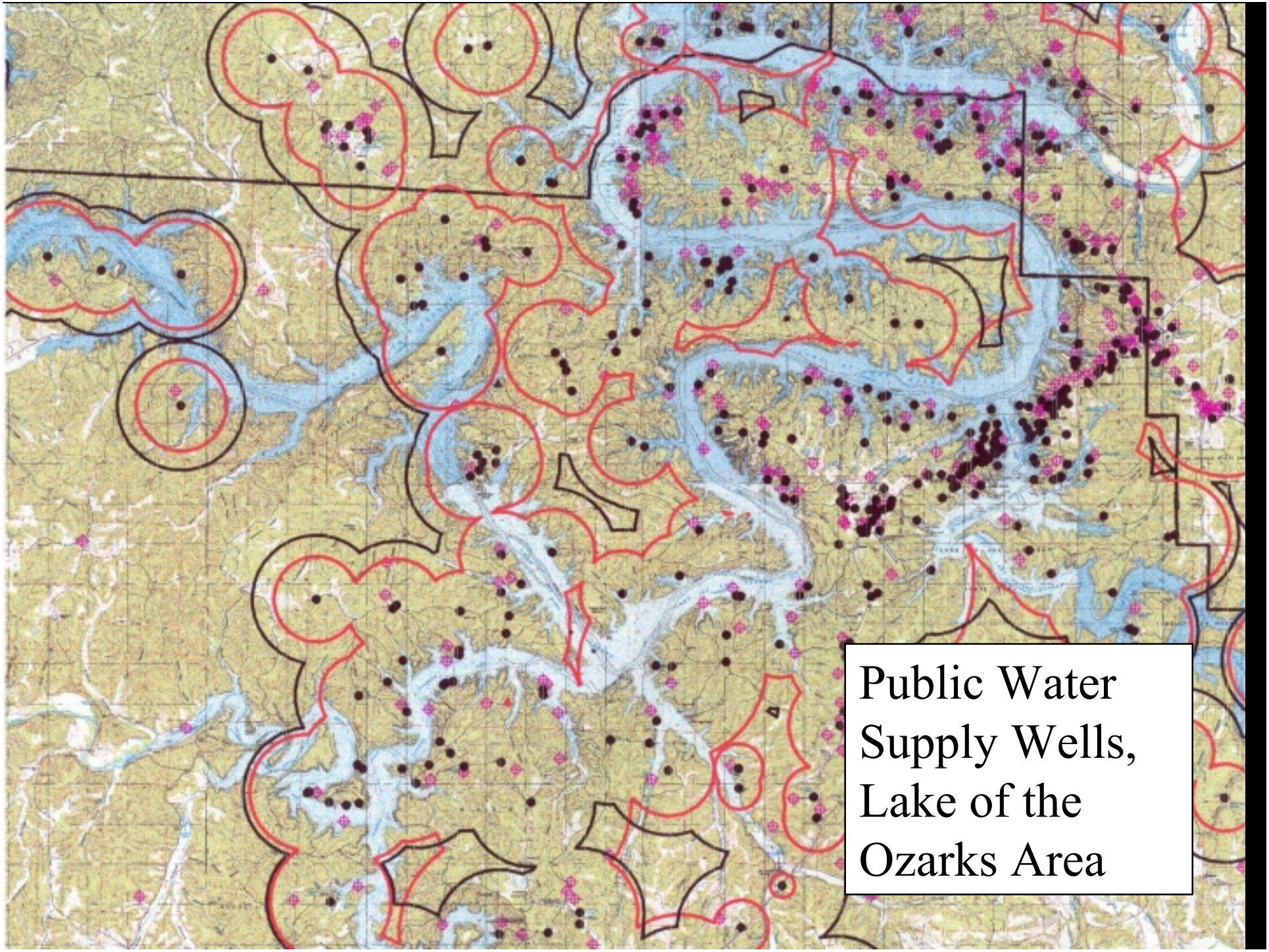
Water Sources in Missouri

Surface Water

- Lakes
- Reservoirs
- Rivers

Ground Water

- Wells
- Springs


Public Water
Supply Wells,
Lake of the
Ozarks Area

Source Water Protection

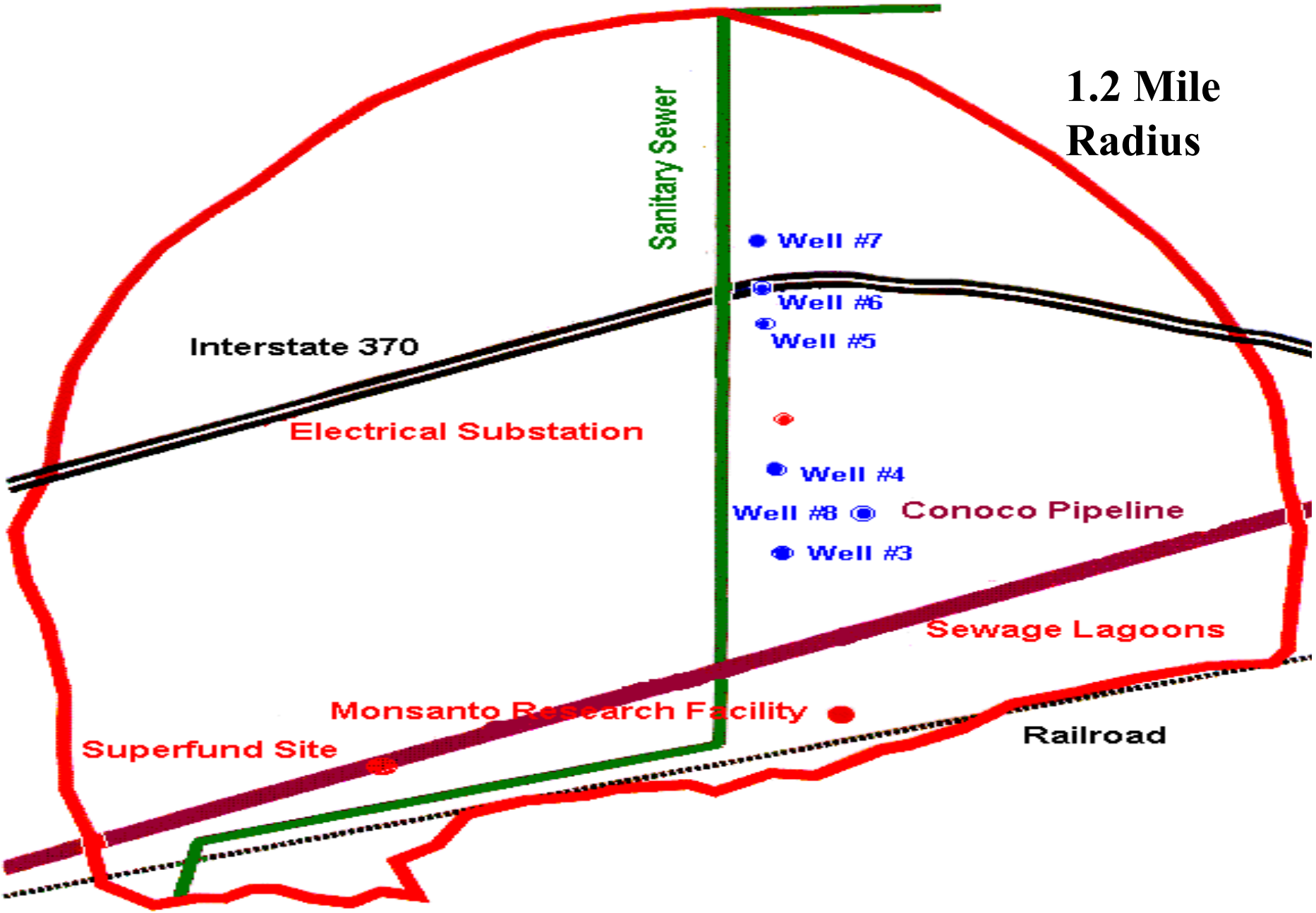
A common sense approach to protecting water supplies by:

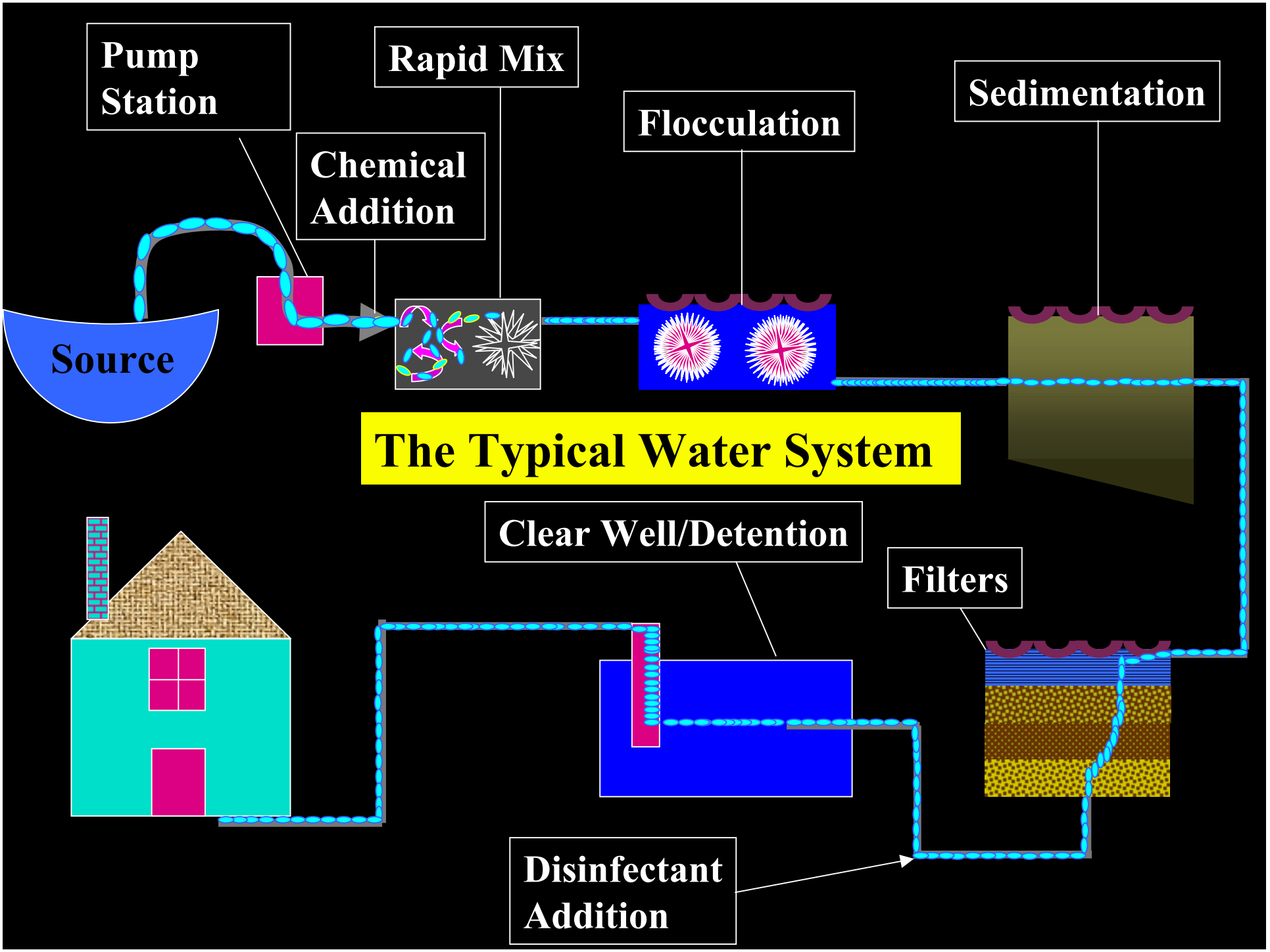
- Preventing contamination
- Reducing the need for treatment
- Managing potential sources of contamination
- Regionalizing water & wastewater
- Contingency planning (alternate sources)


Diesel
Well by
Fuel Pumps


Good Sanitary Seal
but some
Well Head Protection
Concerns

Significant Potential Contaminants




Pump Station
Rapid Mix
Chemical Addition
Flocculation
Sedimentation
Source
The Typical Water System
Clear Well/Detention
Filters
Disinfectant Addition

Drinking Water Treatment

- Conventional water treatment process
- Regulated contaminants
- Disinfectants
- Other concerns

Regulated Contaminants

- Microbiological contaminants; bacteria, viruses, protozoans
- Organic chemicals; PCBs, VOCs, SOCs, DBPs (HAA5 & TTHMs)
- Inorganic chemicals; metals and non-metals
- Radiological contaminants

Other Concerns

- Taste & odor
- Disinfection vs. DBP
- Management of distribution system
- Storage & sanitary deficiencies
- BIO-terrorism & security
  - * Chemical warfare
  - * Biological warfare
  - * Physical security

Taste and Odor Problems

- Rotten egg odor/ hydrogen sulfide-
- Biological decay of organic material/
- Naturally occurring minerals - iron and manganese

Preventing Taste & Odor Problems

- Routine flushing program
- Maintain adequate chlorine residuals throughout system
- Stable water - good water quality parameters (pH, temperature, alkalinity, etc.)

Disinfection is Important

- Chlorine - immediate bacteria kill vs. DBPs formation (risk vs. risk)
- Chloramines - long lasting residual, less DBP formation
- Chlorine dioxide - dangerous, DBPs, risk management plan for >2500 lbs.
- Ozone - expensive
- Ultraviolet (UV) - no residual

Water Storage

Online edition of India's National Newspaper
Tuesday, Dec 17, 2002

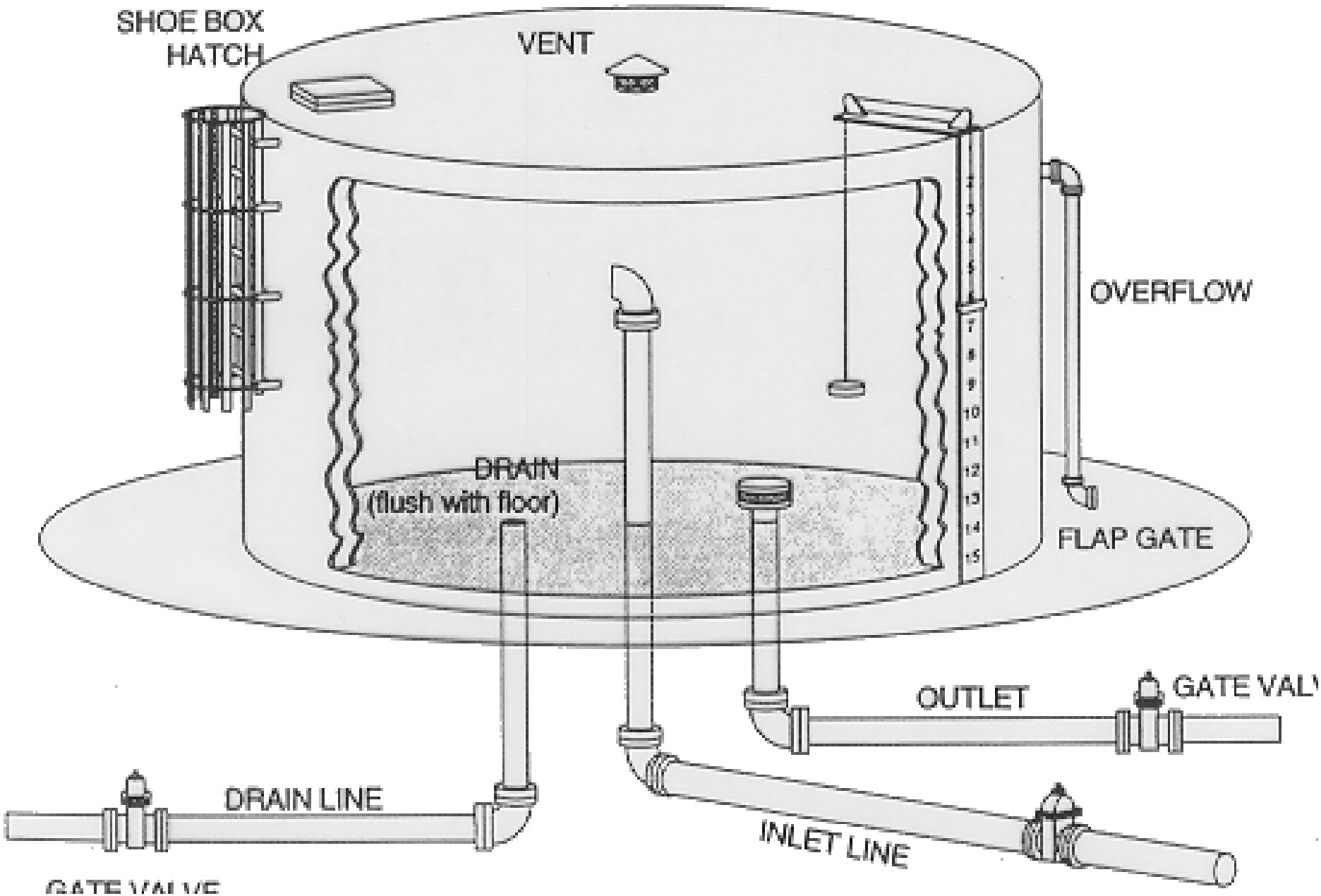
Body found in hospital's drinking water tank

CUDDAPAH Dec. 16. The decomposed body of a 30-year-old unidentified man was fished out from the ground-level drinking water tank in Cuddapah Government Hospital on Monday. The man's bloated body in the water tank at the rear end of the hospital was detected after drinking water emanated foul smell. The body bore no external injuries and was suspected to have been in the tank since three or four days.

Water Storage Facilities

- Towers
- Tanks
- Standpipes

Large tank - ground storage



Sanitary Defects in Storage

Account for approximately 80% of bacteriological MCL violations

Inspect for sanitary defects often

(2-5 years recommended for sanitary, structural, and paint inspection)

A Few Sanitary Points of an Inspection of Storage Tanks

- Gates, hatches and manways locked and secured (Hatches are located on top of tank)
- Hatches, vents and overflow pipes properly screened against insects, birds, etc.

A Few Sanitary Points of an Inspection of Storage (cont)

- Check vents and overflows for signs of insects and birds
- Check tank for gaps or holes following maintenance; seal them
- Assure that automatic warning devices are operational
- Pump pits are locked
- Lighting is good

Standpipe Susceptible to Vandalism

Fencing Needed

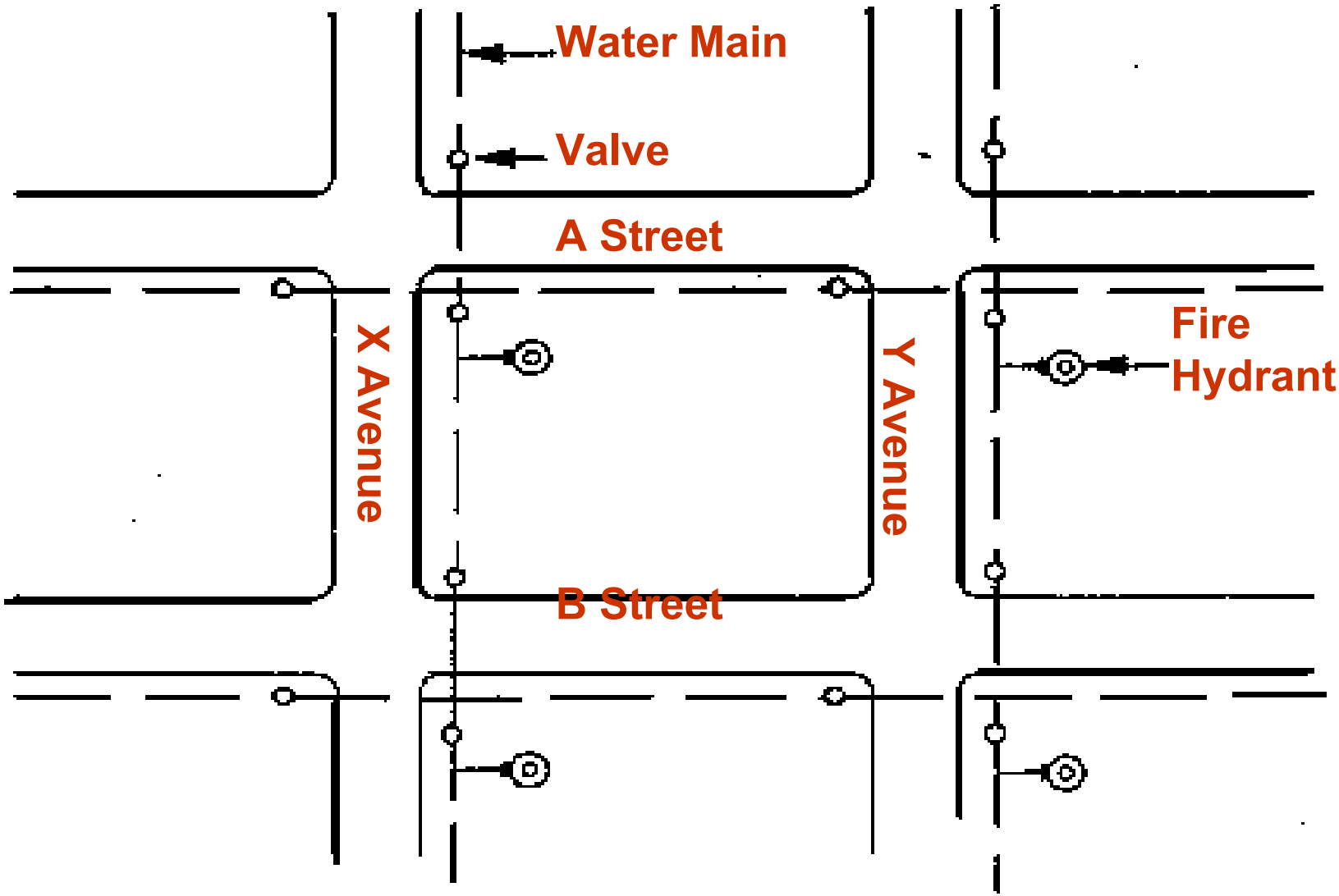
Water Distribution

- Good corrosion/deposition control important operational aspect
- Pressure stability - prevent siphoning contaminants
  - Maintain > 20 psi
- Pressure surges
  - Pump cycling procedures
  - Valve openings

Water Distribution

- Annual valve exercise program
- Water main flushing program
  - Semi-annual or more frequently
  - Dead end lines more frequently
- Leak detection & repair program
- Eliminate dead-end mains (loop system for consistent Cl_2 and no stagnant water)

Grid Network - isolate areas



Cross Connection/ Backflow Defined

A physical connection between otherwise separate piping systems containing potable water and any contaminate, whereby water may flow between the two systems.

Cross Connection/ Backflow Prevention

Types of cross connections

- Pipe-to-pipe connection
  - Contaminated water pipes linked to potable water pipes
- Pipe-to-water connection
  - A hose from from a potable water supply submerged into contaminated water

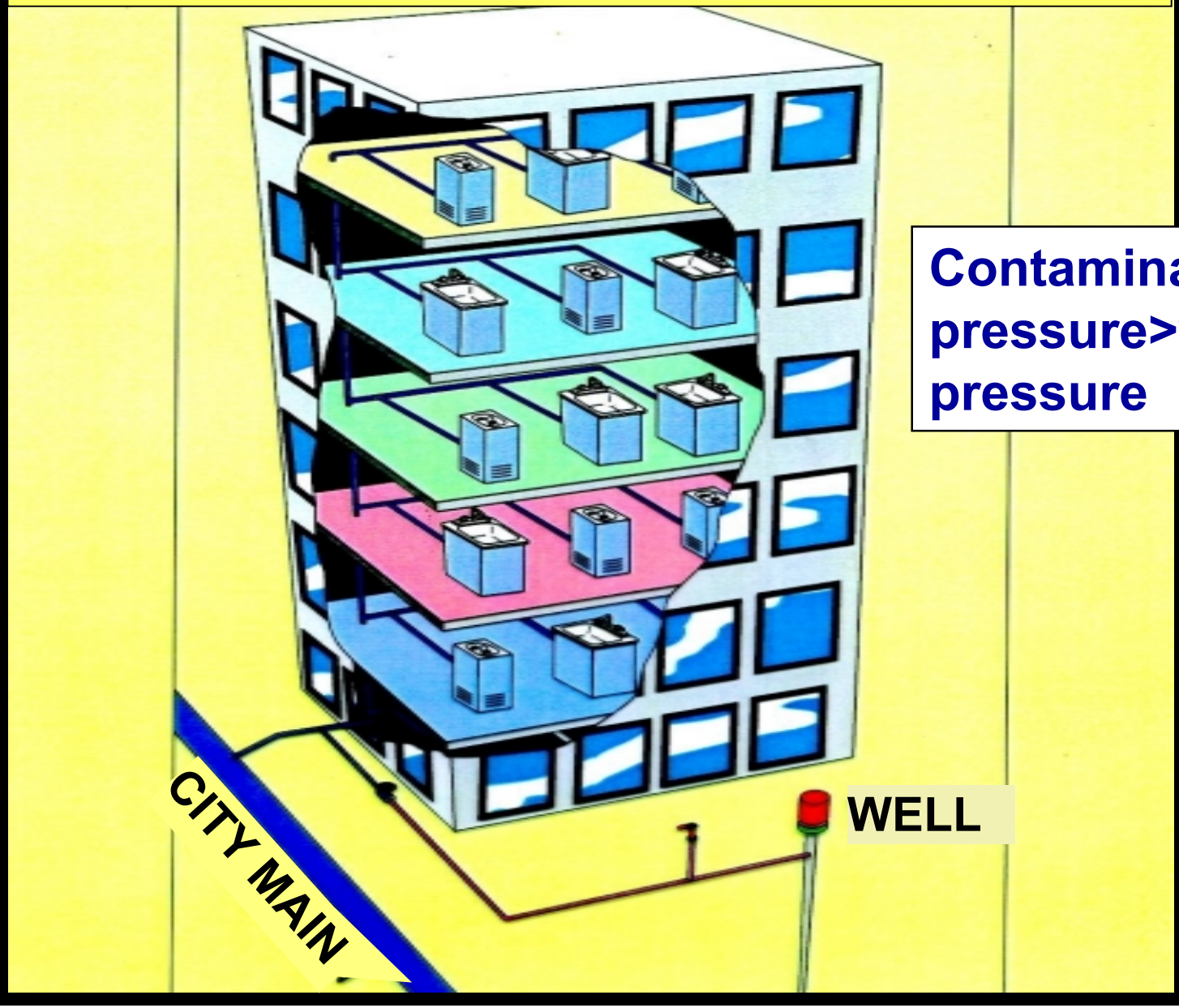
Cross Connection/ Backflow Prevention

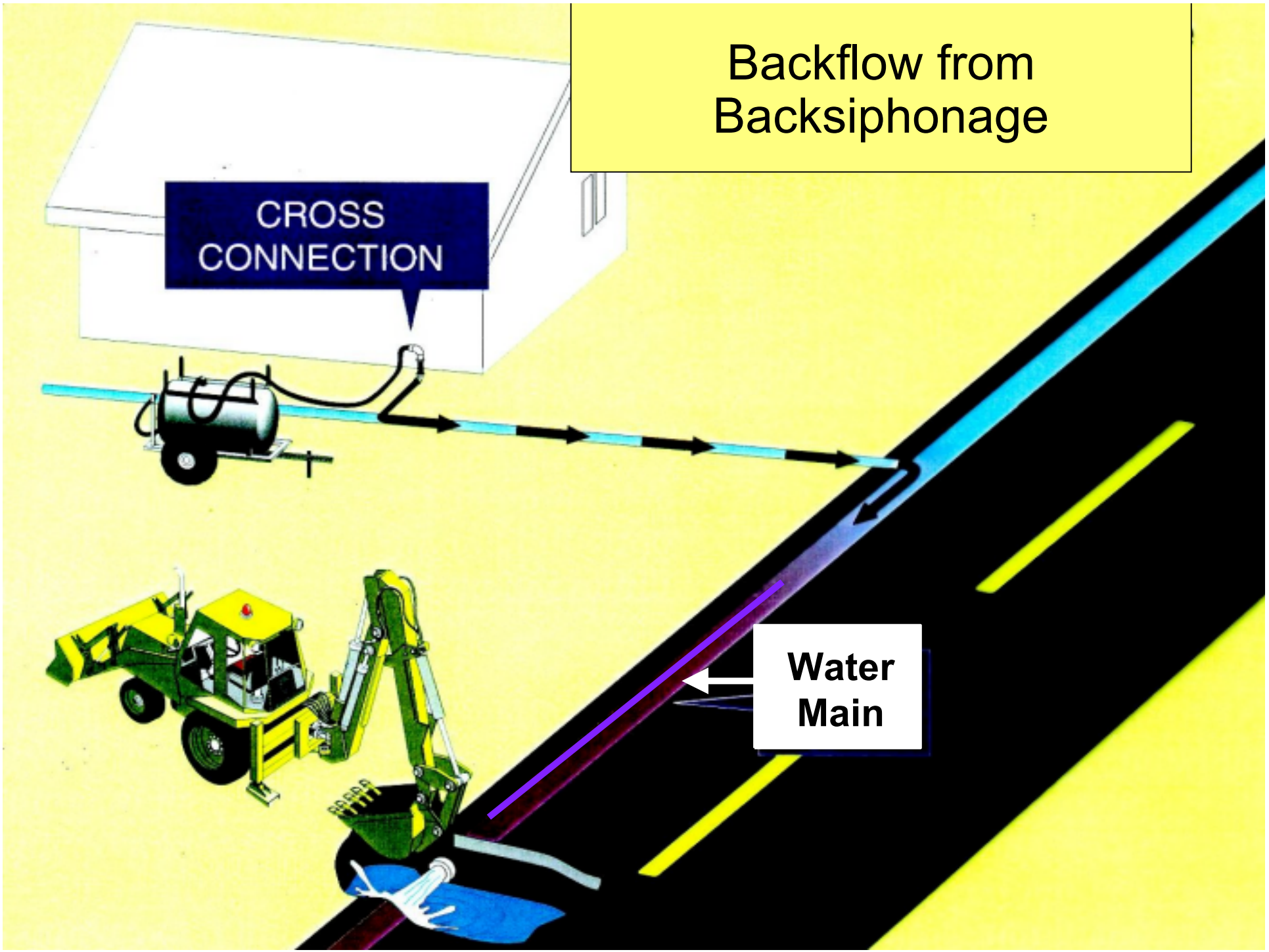
Types of hazards

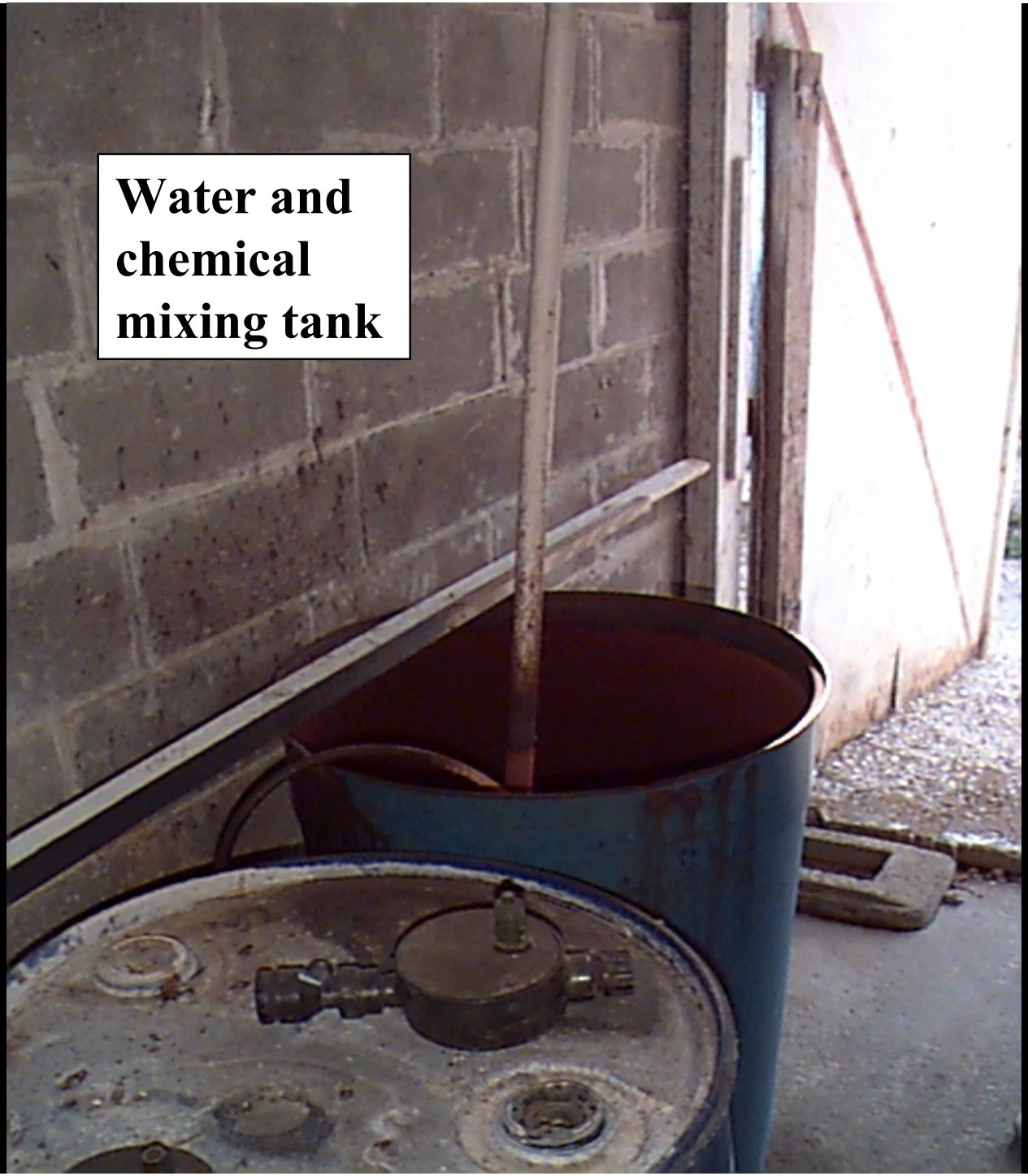
- Backpressure backflow
  - Contaminated water pressure > potable water pressure
- Backsiphonage backflow
  - Negative pressure


By the way, is this a transient, non-community water system or what?
Any backflow concerns here?

Back pressure from hydraulic head

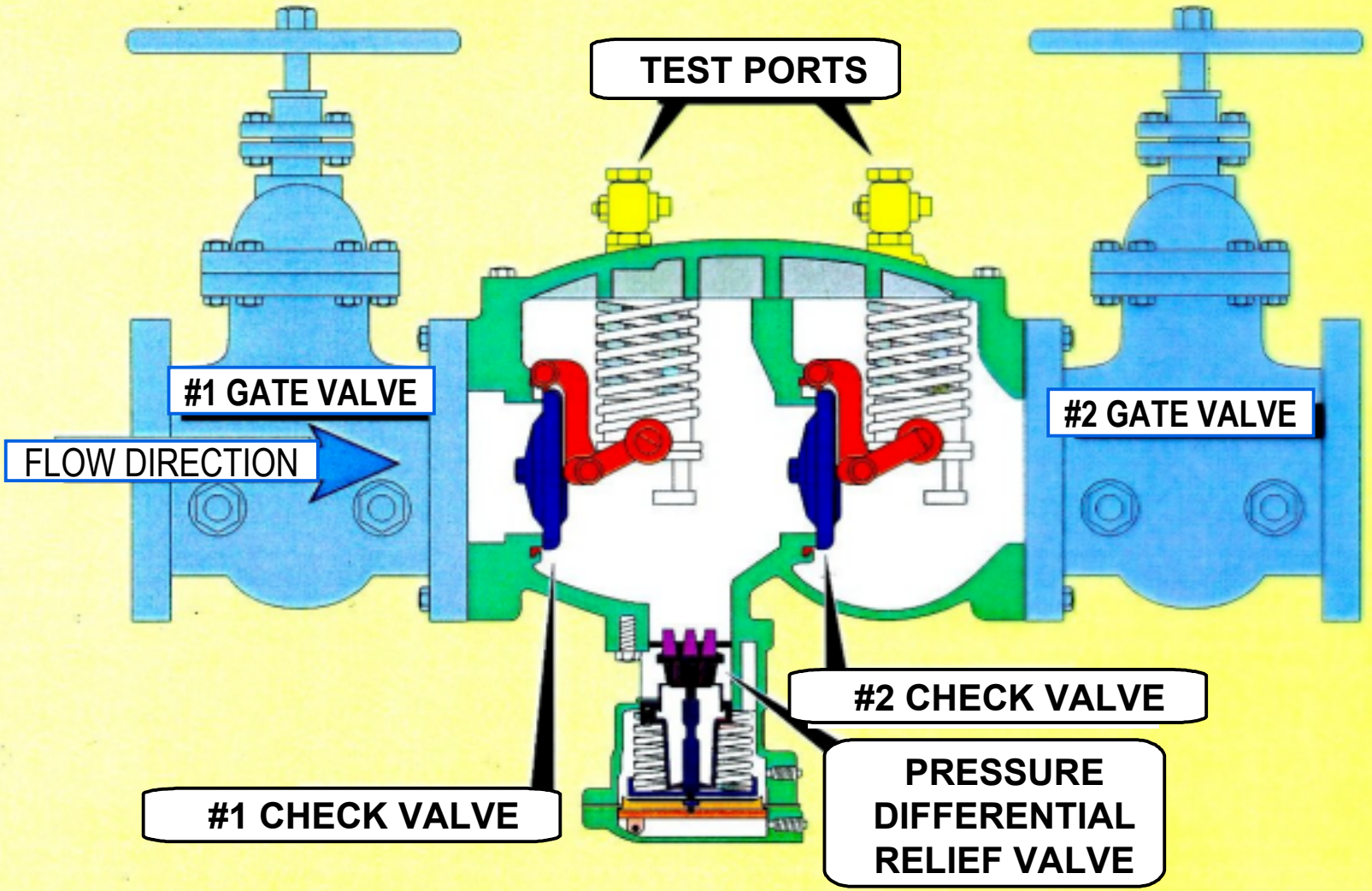



Backflow from
Backsiphonage
CROSS
CONNECTION
Water
Main


Water and
chemical
mixing tank


Stock
watering

Reduced Pressure Zone Backflow Prevention Assembly (RPZ)



Cross Connection/ Backflow Prevention

Components of an ordinance

- Authority for program establishment
  - State Regulation 10CSR 60-11.010
  - Local authority
- Technical provisions related to eliminating backflow and cross connections
- Penalty provisions for violations

Cross Connection/ Backflow Prevention

Components of an ordinance

- Program of routine risk evaluation (site specific vulnerability)
- Program of backflow prevention device testing and repair (annual testing is required)
- Requirements for backflow assembly testing personnel


WORLD PEACE

Terrorism Goals

Death & destruction

Demoralization

Disruption

- **Overloading medical services**
- **Overloading governmental services**
- **Create economic chaos through major traumatic events**

Threats

- Chemical or biological
- Damage or destruction to physical infrastructure
- Disruption to computer systems (cyber attack)
- Disruption to other utilities
  - Electricity
  - Transportation

3 Component Action Plan

Detect - sensors, visual observations, audible observations

Delay - stop intruder before goal is achieved with fencing, keyless entry doors, multiple barriers

Respond - response time must be less than delay time or bad guy wins

Integrated Emergency Plans

- Incorporate all available resources
- Consider full range of disasters
- Address all phases of emergency management - prevention, mitigation, response, and recovery
- Incorporate all levels of government and private sector

Planning for Continuous Service

1. Source water valve system
2. Lightning protection for water source and storage
3. Storage tank isolation for maintenance, inspection, cleaning
4. Dual/backup source water service and feed pumps

Planning for Continuous Service

5. Adequate notification emergency control system for pump outage, low water storage level, pump failure etc.
6. Direct source water to service line access (bypass storage)
7. Individual service connection metering for water use and leak detection

Planning for Continuous Service

8. Meter check and change out program (every 5 to 7 years or at meter life change out)
9. Isolation valves for service repair (Grid network is one method)
10. Flush hydrants at dead-ends with isolation capacity

Planning for Continuous Service

11. Semi-annual flushing program (from source to end of distribution)
12. Loop dead-end lines to prevent taste and odor problems and stagnant water. This reduces flushing frequency and ensures disinfection consistency.

Technical and Financial Assistance Sources

Apply for grants & loans to the Water & Wastewater Review Committee

- Department of Natural Resources' SRF, direct loans & grants
- USDA Rural Development
- Department of Economic Development, CDBG

Technical and Financial Assistance Sources

Federal Agencies

U.S. Department of Agriculture

- Rural Business & Cooperative Development Service
- Rural Economic & Community Development

Technical and Financial Assistance Sources

State Agencies

Department of Economic Development

- Community Development Block Grants Program (CDBG)

Department of Natural Resources' Public Drinking Water Program

- Regional Offices
- Environmental Assistance Office

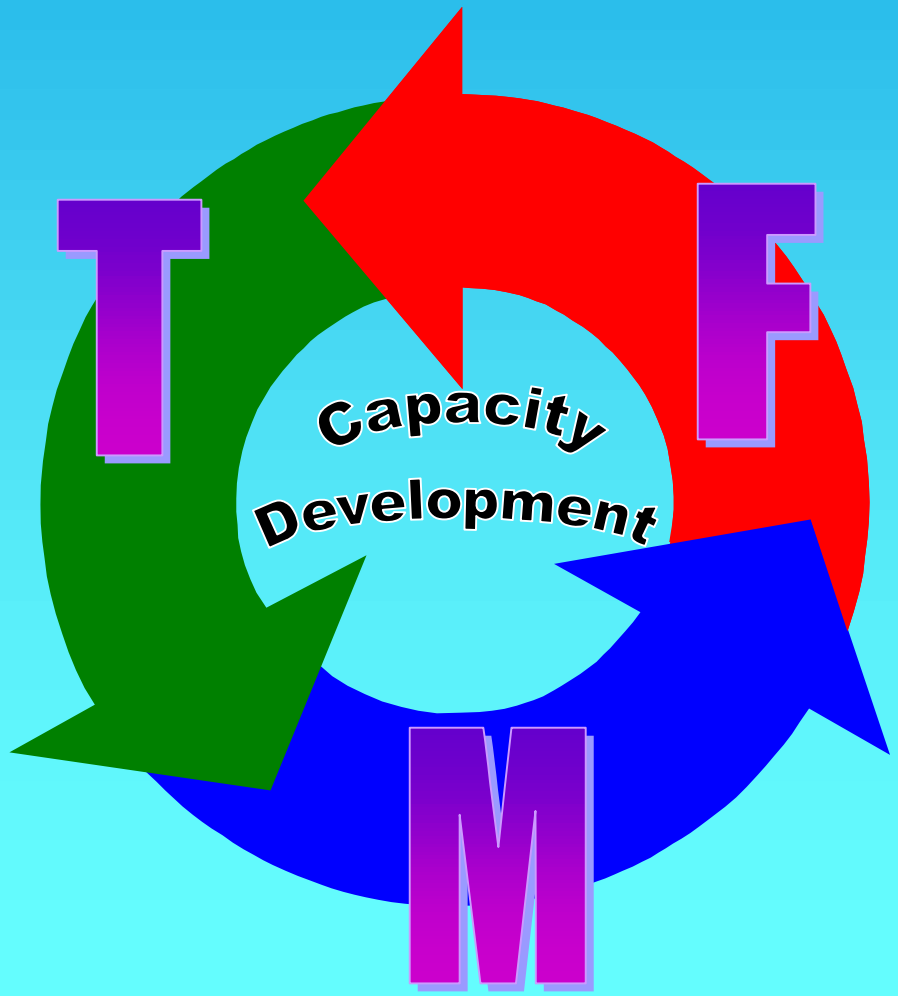
Missouri Department of Natural Resources

Technical and Financial Assistance Sources

Other Agencies

- Missouri Rural Water Association
- Midwest Assistance Program
- Regional Planning Commissions and Councils of Government

Technical, Managerial, Financial Capacity



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Questions?

Postscript

Water Storage Facilities

Elevated tanks/towers

- Placed at high elevation location
- Float or other switching mechanism signals pump to refill tank

Water Storage Facilities

Standpipes

- Above ground
- High point location for pressure
- Main purpose for pressure, not much storage

Water Storage Facilities

Reservoir/large ground tank

- Typically 1 day + storage
- Water pumped to system
- Can fill during off hours to meet peak demand, therefore:
  - Well pump size can be reduced
  - Fewer pump on/off cycles extends pump life

Regulated Contaminants (cont.)

Surface Water Treatment Rule

- Distribution system chlorination
  - 0.5 Mg/l at entry point
  - 0.2 Mg/l at all distribution points
  - Adequate contact time (usually 30 minutes) for virus removal

Regulated Contaminants (cont)

Inorganic chemicals

- Metals - Lead, Copper
- Nonmetals - Nitrates

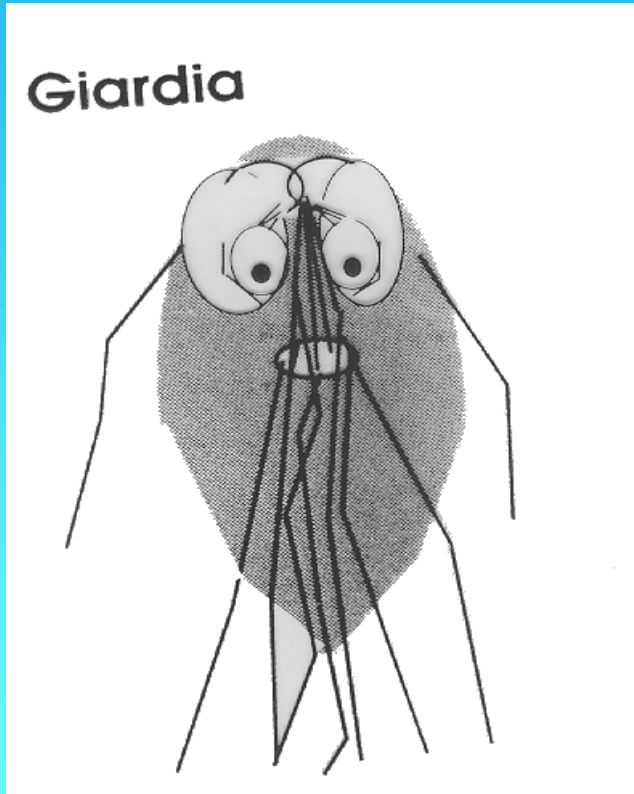
Radiological contaminants

- Radium, Uranium, Radon

Regulated Contaminants (cont.)

Surface Water Treatment Rule

- Turbidity
  - < 0.5 NTU 95% of time
  - < 0.3 for 10,000+ pop
- Disinfection
  - 99.9% Giardia lamblia removal
  - 99.99% virus removal - need adequate CT



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Regulated Contaminants (cont.)

Disinfection By-product Rule

* THMs - 0.08 ppm (will be reduced to 0.06 ppm in near future)
* HAA5 - 0.06 ppm (will be reduced to 0.04 ppm in near future)

Water Distribution, Storage & Planning

- Managing a distribution system
- Water storage
- Cross-connection control
- Terrorism & emergency planning
- Planning for continuous service-needs/budgeting

Terrorism Threats

Biological and chemical contaminants

- Could be released anywhere in system
- Difficult to obtain and deliver contaminants in large enough quantity to affect larger systems
- Current treatment may already be effective for many contaminants

Threats

Biological and chemical contaminants

- Smaller quantities could contaminate part of distribution system
- Potentially lethal chemicals, such as chlorine, are routinely stored in large quantities near drinking water and wastewater facilities. Destruction of chemical containers could release dangerous fumes and upset the disinfection process.

Threats

Physical Destruction

- Drinking Water
  - System infrastructure
  - Upstream infrastructure
- Wastewater - same, especially -
  - Manholes provide access to place hazardous materials into sewer systems

Threats

Cyber Attack

- SCADA (computer based supervisory control and data acquisition systems)

Threat Agents

Nerve

Blister

Choking

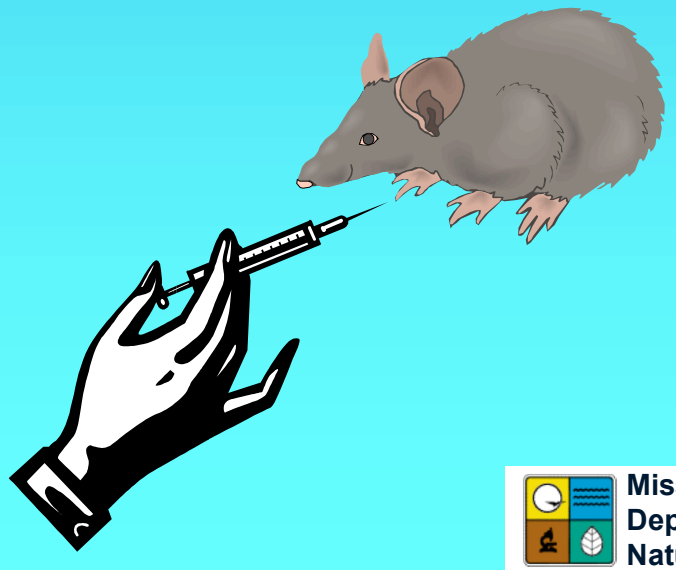
Blood

Hallucinogens

Toxins

Pathogens

- Bacteria
- Viruses
- Protozoa



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For More Terrorism Information, go to:

- US Environmental Protection Agency
- US Public Health Service
- Centers for Disease Control
- Federal Bureau of Investigation
- State Department of Health
- State Emergency Management Agency
- In case of an emergency, dial 911 or local police department